THE CAMBRIDGE STATISTICS DISCUSSION GROUP

Tuesday 3rd February 2026 7:15 for 7:45

Large Lecture Theatre,
MRC Cognition and Brain Sciences Unit,
Chaucer Road, Cambridge, CB2 7EF

Connecting the False Discovery Rate to shrunk estimates

Nick W Galwey
Former Statistics Leader, Research Statistics, at GlaxoSmithKline Research and Development (Retired)

Abstract: Science is currently facing a 'replication crisis' – a concern that many scientific findings reported are difficult or impossible to reproduce. A major cause of this is the availability of technology that permits the exploration and testing of very large numbers of hypotheses, some of which will almost certainly show large or significant effects by chance, even when no real effects are present: this is the 'multiplicity' or 'multiple testing' problem. The statistical tools available to address this problem include:

- the False Discovery Rate (FDR), which is specified in relation to the subset of the *m* hypotheses tested for which the discovery of an effect is reported, and which indicates the proportion of these 'discoveries' that is expected to be false; and
- shrunk estimates, which reduce the estimated effect, in relation to every individual hypothesis, from the observed value towards the null value.

This talk will first examine the conceptual basis for each of these tools, then consider how they are connected. Though the FDR and shrunk estimates are both conventionally presented in the frequentist statistical framework, they can both also be presented in empirical-Bayesian terms, the prior probability distribution being calculated from the data relating to the *m* hypotheses tested, as follows:

- in the case of the FDR, from the proportion of the *m* significance tests conducted that give a *p*-value at or below the specified significance threshold, and that are therefore announced as 'discoveries'; and
- in the case of shrunk estimates, from the distribution of the observed effect sizes over the *m* hypotheses.

Based on this connection, a formal relationship between FDR values and shrunk estimates will be presented. It will be argued that these two tools can profitably be used in conjunction, and their combined application, both to real (human gene-expression) data and to simulated data, will be illustrated.

Speaker: Nick was a demonstrator and lecturer in biometry and plant breeding at the University of Cambridge between 1979 and 1995. He then moved to Perth to lecture at the University of Western Australia from 1995 to 2001, before working as a statistical geneticist for Oxagen Limited for two years. He worked in similar roles for GlaxoSmithKline from 2003 until September 2024, when he retired. His most recent book is:

Galwey, N.W. (2025) The False Discovery Rate: Its Meaning, Interpretation and Application in Data Science. Chichester, UK: Wiley. 266pp. ISBN 9781119889779

Directions: (From Central Cambridge) Chaucer Road is off Trumpington Road – if you are heading away from the city centre it is the first right after the junction with Brooklands Avenue. Number 15 is at the end on the left and is a large Victorian House with a more modern extension to its right. The entrance is in the porch located in the middle of the older section on the left as you come in and is accessed by ascending a few steps from the car park. Cars may be parked there. Note due to building work please enter and leave car park via the 'OUT' entrance (the second of the two entrances on the left as you go down Chaucer Road). The outside door will be locked at 7:45.
Arrivals after 7:45pm can gain admittance by contacting the secretary on 07761769436. A map showing the location of the unit is at http://www.mrc-cbu.cam.ac.uk/contact-us.

Provisional Next Meetings:
11th March – Paul Fannon (Department of Genetics: Bioinformatics Training Facility) on 'How can the pedagogy of statistics inform the teaching of machine learning?'
April – Daniela De Angelis (Biostatistics) on 'Real-time nowcasting and forecasting of COVID-19 dynamics in England'.

Supper: Some members eat regularly in Wetherspoons (St Andrew's Street) before each meeting **at 5-15pm**. All welcome !
Subscriptions: of 1 pound are now due for attending the 2025-2026 session.
Secretary: Peter Watson, MRC Cognition and Brain Sciences Unit, 15 Chaucer Road, Cambridge CB2 7EF; telephone 01223 769479; E-mail peter.watson@mrc-cbu.cam.ac.uk

Slides and .mp3 files of old talks: http://www.mrc-cbu.cam.ac.uk/people/peter.watson/csdg.html
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